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中国与西欧国家股票市场与房地产市场非线性之因果关系

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Non-linear Causality between the Stock and Real Estate Markets of China and Western European Countries

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摘　要

本研究我们使用非对称门坎协整模型检定来探讨中国与西欧国家房地产市场与股票市场是否呈现任何显着非对称之调整关联性，实证结果指出深圳股票综合指数与房地产价格指数存在长期非线性之关联性，我们更进一步使用 Granger 因果关系检测短期内中国财富效果之假设，我们发现，在长期情况下; 在门坎之上存在信用价格效果而在门坎之下则存在财富效果，此结果亦即两个市场存在双向回馈之因果关系，代表中国在在股票与房地产市场之价格传递效果长期下是呈现非线性与非对称之现象。接着，我们再进一步发现在西欧国家长期之下也存在门坎效果，代表股票市场与房地产市场存在单向或双向之因果关系，亦即在门坎上下，西欧国家这两个市场存在财富效果与信用价格效果，在此提供对宏观经济一个更有效的解释意涵。

更进一步，我们使用 Breitung (2001)提出之无母数序检定方法来检测中国之股价指数与房地产之关联性，结果发现中国这两个市场也同样存在非线性之关系，在短期下这两个市场符合财富效果之 Granger 因果关系，长期之中在门坎值之上时符合信用价格效果，而在门坎值之下则符合财富效果，此结果亦即在中国股票市场与房地产市场存在双向回馈因果关系。同时我们也发现在西欧各国之中房地产与股票市场长期下存在价格传递效果且呈现非线性与非对称之关系。接着使用 Breitung (2001) 之无母数序检定协整方法也发现这两个市场长期下存在非线性之均衡关系。在西欧国家中，研究结果明确表明长期下存在双向回馈因果关系; 同时我们也发现在西欧各国之中房地产与股票市场在门坎上下存在单向与双向因果关系，最后可由实证结果指出西欧各国房地产与股票市场分别符合财富与信用价格效果，而金融机构与个别投资者可用此结果来分别建立长期之投资组合。

关键词：因果关系 门坎误差修正模型 财富效果 信用价格效果

ABSTRACT

In this study, we use the asymmetrical threshold cointegration tests to investigate whether any significant relationship and asymmetric adjustment exists between real estate and stock markets in China and Western European countries. Our result indicates that Shenzhen composite index and real estate price index existed long-run nonlinear relationship. Furthermore, from Granger-Causality test is in favor of the wealth effect hypothesis in the short run. In terms of long-run situation, we detect that credit-price effect exists above threshold value, whereas wealth effect exists below threshold value, which implies a bidirectional feedback causality relationship. These empirical results demonstrate that the price transmissions between these two markets are nonlinear and asymmetric in the long-run in China. Next, the findings clearly point to the existence of long-run unidirectional and bidirectional causality between the real estate market and the stock market in Western European regions both above and below the threshold level. We find the existence of both wealth and credit price effects in the real estate markets and stock markets of Western European countries, again both above and below the threshold value, which thereby offers a better interpretation of the meaning of the macroeconomic factors.

Furthermore, we use the non-parametric rank tests proposed by Breitung (2001) and our results indicate the existence of a long-run non-linear relationship between the Shenzhen composite index and the real estate price index. We go on to adopt the threshold error-correction model (TECM) to determine whether a similar relationship is discernible possibly non-linear functions of the log-price of these two markets in China and Western European countries. In the short run, the Granger causality test favors the ‘wealth effect’ hypothesis; conversely, in the long run, the existence of the

‘credit-price’ effect is discernible above a certain threshold value, whilst the ‘wealth effect’ is apparent below this threshold value, which implies a bi-directional feedback causal relationship in China. Our empirical results demonstrate that in the long run, the price transmissions between these two markets are non-linear and asymmetric in Western European countries. Second, using the non-parametric rank tests proposed by Breitung (2001), we set out in this study to determine whether any non-linear long-run equilibrium relationship exists between the stock and real estate markets of Western European countries. In Western European countries, the findings clearly point to the existence of long-run unidirectional and bidirectional causality between the real estate market and the stock market in regions both above and below the threshold level. Finally, we find the existence of both wealth and credit price effects in the real estate markets and stock markets of Western European countries, which thereby offer financial institutions and individual investors in their construction of long-term investment portfolios within these two asset markets.

Keywords: Causality, Threshold Error-Correction Model (TECM), Wealth Effect, Credit Price Effect

目　　录

1. Introduction

Over recent decades, a wealth of studies has been undertaken to investigate the relationship between the stock market and the real estate market. The identification of such relationship is critical for both investors in these two markets and policymakers who need such information prior the designing of a national growth strategy. Disturbances in market fundamentals in a given market generate movements of capital into and out of the affected market (Okunev and Wilson, 1997). If stock and real estate markets are well integrated then it is expected that a high degree of asset substitution will take place, such substitution having a significant impact on price fluctuations in the relevant markets. On the other hand, if the two markets are not integrated, then this has significant implications for portfolio investment where managers seek to develop well diversified portfolios. Economic growth in China has been spectacular in recent years and it also has become one of most popular investing country, causing stock price and real estate price both reach its record-high. From 2001 to 2005, global housing prices have a rising tendency; housing prices also rocketed in China by 68%. The irrational exuberance signifies to some experts that this is a bubble that sooner or later will burst. Riding in an opposite direction, the stock markets have slid all the way for more than four years and lost more than 50% of value in the stock index during that period. Surprisingly, China's two stock exchanges (the Shanghai and Shenzhen stock exchanges) were Asia's worst performing markets despite a 9.5% GDP growth in 2004. Nevertheless, the stock price surge due to the Beijing Olympic Games during 2007 to 2008, but it slid again after Olympic Games. It is interesting that whether the two markets were systematically linked, did the plummeting stock price cause the surge in the real estate market, or did the development of the real estate market lead to a further plunge in the stock markets. In this study, we attempt to take a look in China's stock and real estate markets.

It has been clearly demonstrated within the prior literature that any attempt at precisely determining the relationship between the stock market and the real estate market remains somewhat contentious; and indeed, regardless of whether this relationship is examined over the short-term or the long-term, it remains unsettled as to whether the two markets are segmented or integrated. Of special interest to anyone observing the fluctuations are stock and real estate markets. For investors, whilst the growth of stock market alliances and mergers within the European Union signals increased institutional integration in European capital markets, there has also been growing interest in the implications of this process for investment decisions and strategies. Where consequences are identified for the level and pattern of business and investment activity, there will also be significant effects on the level and pattern of real estate performance.

The massive fluctuations that are discernible in Western European asset prices have often been considered to be a boom and subsequent bursting of the bubble (boom and bust cycle); however, in the second half of the current decade, a much bigger boom-bust cycle has been experienced by the asset markets of Europe (primarily the stock and real estate markets) than by any other sector of the economy. Not only do these tremendous shifts in asset prices have a huge impact on the net worth of property assets, but they also have significant and persistent effects on real economic activities. Such major fluctuations may come about through relatively infrequent, but nevertheless important events, notably oil shocks or changes in fiscal and other policy regimes, with such events ultimately affecting the macro- and micro-economic performance of a country, and also changing the very nature of its economic relationships. Perron (1989) concludes that business cycles are in fact transitory fluctuations around a more or less stable trend path, thereby resulting in non-linear phenomena.

This study will investigate asymmetric price transmissions between the stock and real estate markets in China. We implement the momentum threshold autoregressive (M-TAR) model proposed by Enders and Granger (1998), and Enders and Siklos (2001). This model extends the original cointegration models to deal with the problem of low power of unit roots and coitegration tests in the presence of asymmetric adjustment (Menezes *et al.*, 2004). The testing framework used here has the advantage that it preserves the linear long-run or cointgrating relationship preferred by the existing theoretical framework, while permitting threshold adjustment in the error correction terms. In addition, the momentum framework is appealing from an economic perspective, and the relevant tests have demonstrably more power than conventional threshold adjustment models. Also, we can clearly point out different effect occurs in variables above or below threshold. Most important of all, the technique is practical since the form of asymmetry investigated here is fairly commonplace in financial time series analysis. In the final test, the result from Granger-Causality test based on corresponding threshold error correction model (TECM) reveals unidirectional causality running from the stock market to real estate market, that is to say, there exists wealth effect in the short run in China. Further, asymmetric price transmissions between these two markets are also found in the long run. Understanding the causes and underlying transmission channels will help policymakers to correct the imbalance as China's stock and real estate markets reforms are still ongoing.

Perron (1989) concludes that business cycles are in fact transitory fluctuations around a more or less stable trend path, thereby resulting in non-linear phenomena. In similar fashion, we argue that a non-linear relationship may exist within European countries. Furthermore, we note that in the majority of the prior empirical studies

addressing the issue of equilibrium, most of the models fail to take into consideration the asymmetric properties of the adjustment process in both the real estate market and the stock market.

Next, conventional cointegration methods are inappropriate, essentially because they assume a unit as the null hypothesis, and a linear process under the alternative; hence, Enders and Granger (1998) and Enders and Siklos (2001) propose the use of the asymmetric 'threshold auto-regressive (TAR) model and the 'momentum-threshold auto-regressive (M-TAR) cointegration tests, indicating that the application of non-linear models using macroeconomic variables is likely to become the mainstream methodology. These models are equipped to provide the requisite empirical evidence favorable to the elucidation of long-run relationships through the use of error correction mechanisms or by permitting asymmetric adjustment.

Needless to say, there are several other non-linear candidate models which might also be capable of explaining the evolution of the behavior of the variables; however, the testing framework used here has the added advantage that it preserves the preferred linear long-run (or cointegrating) relationship in the existing theoretical framework, whilst also permitting threshold adjustment in the error correction terms. The momentum framework is also appealing from an economic perspective, since the relevant tests have demonstrably more power than conventional threshold adjustment models. Most importantly, since the asymmetry investigated in this study is a fairly commonplace form in financial time-series analysis, the proposed technique is simple to implement whilst also being extremely practical.

Given that the economic variables are all non-linear variables, Caner and Hansen (2001) also suggest the use of the M-TAR specification. As compared to the conventional cointegration approaches, M-TAR produces more convincing evidence,

essentially because it has sufficient flexibility that enables it to capture non-linear adjustment patterns. Our primary objective in this study is to ascertain whether there is indeed any significant relationship between the real estate and stock markets in European countries using a non-linear model. We aim to facilitate the forecasting of future performance between one market and the other, thereby providing important and significant insights for investors and speculators.

Next, conventional cointegration methods are inappropriate, essentially because they assume a unit as the null hypothesis, and a linear process under the alternative. It is, nevertheless, clear that the theory is not always capable of providing any precise specification of the functional form, such that non-parametric tools for use in estimation and inference are clearly desirable. The majority of the models adopted in the prior empirical studies addressing the issue of equilibrium have generally failed to take into account the non-linear properties of the adjustment process; however, as noted by Laxton *et al.* (1993), both bias and mistakes are increasingly likely when a linear and symmetrical methodology is adopted to test economic variables that are non-linear and asymmetric.

It is worth noting that in the non-linear evidence referred to in the above studies, the tendency has been to adopt parametric residual-based tests in a cointegrational approach to the testing of the relationship between stock and real estate markets. The present study differs from these earlier examples by providing non-linear cointegrational evidence on China based on the non-parametric rank tests developed by Breitung (2001), which demonstrate power in both linear and non-linear frameworks, and which are also applicable to whatever the data generating process of the variables under examination. In contrast, parametric testing procedures assume that the data generating process is already known in advance; and thus, there is some danger of misspecification if the

wrong parametric models are used to characterize the variables of interest. In similar fashion, we argue that a non-linear relationship may exist within China and Western European countries. Furthermore, we note that in the majority of the prior empirical studies addressing the issue of equilibrium, most of the models fail to take into consideration the asymmetric properties of the adjustment process in both the real estate market and the stock market.

The present study differs from these earlier examples by providing non-linear cointegrational evidence on China and Western European countries based on the non-parametric rank tests developed by Breitung (2001), which demonstrate power in both linear and non-linear frameworks, and which are also applicable to whatever the data generating process of the variables under examination. It is worth noting that in the non-linear evidence referred to in the previous studies; the tendency has been to adopt parametric residual-based tests in a cointegrational approach to the testing of the relationship between stock and real estate markets. In contrast, parametric testing procedures assume that the data generating process is already known in advance; and thus, there is some danger of misspecification if the wrong parametric models are used to characterize the variables of interest.

There are, therefore, several important issues that are of particular interest to this study. Firstly, our primary objective in this study is to ascertain whether there is indeed any significant non-linear relationship between the real estate and stock markets in Western European countries using rank tests proposed by Breitung (2001).While some empirical evidence of the relationship between real estate and stock markets seems convincing, unfortunately thus far none has been proven to be conclusive. This method demonstrates more power than traditional linear or non-linear parametric testing procedures. Secondly, we go on to apply asymmetric error-correction models to

describe the short-term dynamic adjustments with the asymmetric price transmissions between the stock and real estate markets. Our results should facilitate an investigation into the causal relationships between the real estate markets and stock markets of Western European countries. As a result, two mechanisms are proposed within the prior literature for the interpretation of the relationship between these markets. The first of these is the well-known 'wealth effect', which indicates that the stock market is capable of influencing the real estate market. The second contrasting theoretical interpretation of the relationship between the two markets is the 'credit price effect', which claims that a rise in real estate prices can stimulate economic activity, the future profitability of firms, and, as a consequence, stock market prices, as a result of raising the value of collateral and reducing the cost of borrowing for both firms and households. Granger causality will enable us to determine whether the 'wealth effect' or the 'credit price effect' exists within any of the Western European countries that are either above or below the threshold. Our purpose then is to determine the relationship between these markets and what implications it may have for active market traders. One fundamental motivation behind our study is that our findings can yield considerable insight for both investors and speculators that may facilitate forecasting future performance from one market to the other. To the best of our knowledge, this study is the first of its kind to utilize the long-run relationship with rank test and threshold error-correction model to test non-linear cointegration and Granger-Causality between real estate and stock markets.

The remainder of this study is organized as follows. A review of previous studies is presented in next section. A description of the methodology adopted for this study is provided in Section 3. This is followed in Section 4 by the presentation empirical results. Finally, the conclusions drawn from this study are presented in Section 5.

2. Literature Review

In most of the early studies exploring this issue, the tendency has been to adopt linear models as the means of determining the existence of such segmentation or integration, with these studies typically using the 'capital asset pricing model' (CAPM) as their initial starting point; for example, based upon such a model, Jorion and Schwartz (1986) conclude that segmentation influences asset pricing. Liu *et al.* (1990) also follow a similar framework in an attempt to further clarify the issue, exploring whether the commercial non-farm real estate market is integrated with, or segmented from, the stock market using Equity Real Estate Investment Trust (EREIT) extracted from COMPUSTAT tapes and Standard and Poor's (S&P) Security Owner's Stock Guide. Their evidence provides support for the hypothesis that segmentation does exist, albeit based upon indirect barriers such as the cost, amount and quality of information on real estate, as opposed to any legal constraints.

Using a cross-sectional regression analysis of real estate price indices and stock price data on seventeen countries, Quan and Titman (1997) examine the relationship between real estate stock portfolio returns and standard appraisal-based index returns for 17 countries; their results indicate a significantly positive relationship between both real estate valuations and stock returns. Liu *et al.* (1990) find further evidence of market segmentation between the real estate market and the stock market, with their results gaining additional support from the findings of Geltner (1990), who reported discernible differences between the noise component of stock and real estate returns, and thereby concluded that the two markets are probably segmented. In contrast, however, Gyourko and Keim (1992) report totally contradictory findings, with their results providing evidence to suggest that the stock market contains important information on real estate fundamentals and that S&P 500 returns have significant

explanatory power in terms of predicting equity 'real estate investment trust' (REIT) returns[1]. Furthermore, Meyer and Webb (1993) also note that the returns on equity REITs that data indices used from National Council of Real Estate Investment Fiduciaries (NCREIF) in conjunction with the Frank Russell Company (FRC) and Center for Research in Security Price (CRSP), appear to be very similar to the returns on common stocks, thereby suggesting a certain degree of integration between the two markets.

There may well be differences in the initial perspectives of the prior studies which, along with the different models and methodologies adopted, may lead to different empirical results being obtained, and therefore, quite diverse conclusions. It is also worth noting, however, that in many of the prior studies, both the real estate market and the stock market are assumed to exhibit linear behavior, despite the fact that there is growing recognition of the non-linear characteristics of the economic variables. Given that both segmentation and integration have been reported, the fact that the majority of the studies within the prior literature have tended to ignore the possibility that the relationship between the real estate market and stock market could be non-linear may well be the main reason for these different outcomes.[2] A number of the prior studies also suggest that many of the macroeconomic and financial time-series variables, including stock price, are organized by stochastic trends; thus, there is some general recognition that non-linear models are capable of fitting the data.[3]

Liu *et al.* (1990) suggest that the securitized real estate indices, such as REITs, behave very much like common stocks, exhibiting non-linear behavior; they also note

[1] This paper analyzes the risks and returns of different types of real estate-related firms trades on the New York and American stock exchanges (NYSE and AMEX). They examine relation between real estate stock portfolio returns and returns on a standard appraisal-based index, and find that lagged values of traded real estate portfolio returns can predict returns on the appraisal-based index after controlling for persistence in the appraisal series.

[2] Examples include: Schnare and Struyk (1976), Goodman (1978) and Richardson and Thalheimer (1982).

[3] See, for example, Lee and Jeon (1995).